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## ARTICLE

## Ownership Concentration and other Determinants of Covenants in Debt Contracts of Brazilian Publicly Listed Firms

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### ABSTRACT

This article investigates whether the concentration of stock ownership affects the presence and intensity of covenants in the debt contracts of companies listed on the B3 stock exchange in the 2007-2018 period. We also present an overview of the presence and breach of covenants by these firms. For this purpose, we manually analyzed more than 4,000 explanatory notes for the firms' financial statements regarding loans and financing and then applied linear and nonlinear regression models. We found that greater ownership concentration is associated with higher likelihood of the presence of covenants, corroborating the role of the ownership structure as a substitute governance mechanism that allows for aligning interests and reduces the need for using covenants. The results are useful to managers, creditors, and shareholders, by showing which characteristics are determinants of the use of covenants, supporting management of factors that can reduce their occurrence, and bring greater flexibility to the corporate decision-making process, directly maximizing the value to shareholders.

### KEYWORDS

Covenants, Covenant Slack, Ownership Concentration, Waivers, Agency Costs

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## 1. INTRODUCTION

Covenants, or restrictive clauses, are present in most debt contracts, such as bond indentures, aiming to mitigate the agency costs derived from the conflict of interests between creditors and shareholders, as described by Jensen and Meckling (1976). While serving to protect creditors, covenants wind up reducing managers' flexibility in making decisions, by constraining the assumption of new debts, payment of dividends and making new investments/capital expenditures in certain circumstances.

Here we investigate the relationship between ownership concentration and the employment of covenants in debt contracts of firms listed on Brazil's B3 exchange. In countries with weak protection/enforcement of ownership rights, the ownership structure of companies tends to be highly concentrated, operating as a tool to align interests and maximize value, as discussed by Shleifer and Vishny (1997). This occurs due to the incentives for controlling shareholders to reach decisions that bring greater return on capital invested, also benefiting other agents (creditors, minority shareholders, employees, suppliers, and the government), as stated by Claessens and Fan (2002). Therefore, the expectation is that more concentrated ownership structures will tend to reduce conflicts of interest between shareholders and creditors, leading to a lesser need to impose covenants. Thus, high ownership concentration should act as a substitute institutional governance mechanism, as described by Martins et al. (2020), in the scope of debt maturity in settings with weak protection of the rights of minority shareholders and creditors.

This article also presents an overview of covenants of firms listed on Brazil's B3 stock exchange between 2007 and 2018, indicating the recent position of these firms in relation to breaching such clauses (covenant slack), based on an extensive manual collection of the information contained in the notes to the financial statements of the sample of firms. Finally, we also investigate other determinants of the presence of financial covenants in debt contracts, including operational and financial characteristics of the firms. Various authors, such as Demiroglu and James (2010), Qi et al. (2011), Miller and Reisel (2012), Reisel (2014) and Bradley and Roberts (2015), have found that the structure of covenants varies according to the characteristics of companies (e.g., size, growth opportunities, and leverage) and different macroeconomic and institutional contexts (e.g., recession, level of protection of creditors and minority shareholders).

Therefore, in the same way as covenants, the corporate governance mechanisms seek to align interests and mitigate the agency problem derived from the separation between ownership and control of firms, as treated by Jensen and Meckling (1976). According to La Porta et al. (2000), corporate governance is a set of mechanisms through which external investors (creditors and shareholders) protect themselves against expropriation by insiders. These mechanisms can be adopted and guaranteed by the State, by means of protection through effective enforcement of ownership rights, and/or by firms themselves by adhering to good governance principles and practices. As mentioned, a concentrated ownership structure can serve as a substitute for governance to mitigate conflicts between controllers and creditors. Hence, it can be expected that the probability of the existence of covenants in firms' debt contracts will be negatively related with ownership concentration. Based on this premise, our hypothesis is that the intensity of the presence of covenants (as measured by the number of debt covenants a firm has in a given period) also will be negatively associated with greater ownership concentration.

The empirical literature on covenants is relatively recent in Brazil, probably because of the difficulty of accessing databases containing information compiled on covenants, so that such

information needs to be collected manually by examining the notes to financial statements and/or the indentures and prospectuses of bond issues. With respect to the determinants of the use of covenants, the standout studies are those of Konraht and Vicente (2019) and Palhares et al. (2019).

In the first, Konraht and Vicente (2019) analyzed whether the characteristics of the firms (economic-financial and governance) and characteristics of the debt impacted the presence and number of covenants in the indentures of bonds issued via the B3 in the 2010-2016 period. In the second, Palhares et al. (2019) examined a sample of bonds issued through the B3 in the 2011-2017 period to ascertain whether the governance characteristics impacted the number of covenants present in the respective indentures, as well as the intensity of restriction of the Net Debt/EBITDA covenant.

Our study differs from those two by analyzing the presence of covenants mentioned in the notes regarding loans and financing in the financial statements of all nonfinancial firms listed on the B3, not restricting the analysis only to the covenants associated with bond issues. We also contribute to the literature by describing a broader overview of the situation of firms with regard to such clauses, considering the 2007-2018 period, as well as expanding the discussion on the determinants of the presence of covenants, employing various proxies and models.

Through mapping of the notes, we identified the existence of 17 types of covenants related to loans and financing, with a highlight on the ratios Net Debt/EBITDA and EBITDA/Financial Result. Together, these two ratios represented more than half of the observations. On average, the companies were far from exceeding the thresholds established for violating the Net Debt/EBITDA covenant, and the years with greatest breaches were 2015 and 2016, when Brazil experienced a recession. The greatest frequency of violations occurred over this period was in the electric power sector, which was negatively affected by government policies to control electricity prices in those years.

Our results indicate a negative association between the level of ownership concentration and the probability of the existence of covenants in debt contracts of the firms listed on the B3, confirming the role of the ownership structure as a substitute for legal protection of creditors. Factors such as growth opportunities and liquidity also reduced the occurrence of covenants, while leverage and size were positively associated with their presence. These findings rejected our hypothesis, since the levels of ownership concentration did not appear to affect the intensity of contractual covenants.

Our results can be useful to managers, creditors and shareholders by indicating what characteristics are determinants of the requirement for covenants, helping in the management of factors that can reduce this imposition and provide greater flexibility to the decision-making process, with a positive effect on shareholder value.

## 2. THEORETICAL FRAMEWORK

### 2.1. ROLE OF COVENANTS AND THEIR DETERMINANTS IN DEBT CONTRACTS

Restrictive clauses, or covenants, originate from the conflict of interests between creditors and shareholders, serving as a mechanism to protect the former by impeding expropriation by the latter. As discussed by Jensen and Meckling (1976), this transfer of wealth can occur through the management of the company, by adopting risky strategies or investing the loan proceeds in high-risk projects.

According to the Agency Theory of Covenants (ATC), discussed by Bradley and Roberts (2015), in anticipating managers' opportunistic behavior, creditors tend to add the potential cost derived from this conflict in the interest rate, increasing the cost of financing. Since in the final analysis, shareholders bear the cost of financial risk, they accept contracts with restrictive clauses as a way to reduce the cost of debt, as found by Reisel (2014) and Bradley and Roberts (2015).

Furthermore, according to Smith and Warner (1979), the purpose of covenants is mainly to limit the policies on investment, dividends, and financing of a firm, which are the main sources of conflicts. In this respect, Chava and Roberts (2008) report evidence that investments decrease in response to violation of a covenant to the extent that creditors intervene to prevent inefficient investments. In turn, Roberts and Sufi (2009) confirmed that the financing policy of firms changes significantly after the breach of a covenant, causing the company to drastically reduce its leverage, possibly due to the actions of creditors to accelerate repayment, increase the interest rate and prevent additional loans. Nini et al. (2012) also verified that the violation of covenants allows creditors to exercise significant informal influence on companies' governance, as indicated by a greater turnover of CEOs after the announcement of a breach of covenants.

Furthermore, according to the ATC, the presence of covenants is directly related to the financial condition of firms. Further corroborating the theory, Demiroglu and James (2010) found that firms with greater risk and fewer growth opportunities are more likely to obtain financing with the inclusion of more restrictive covenants in the respective contracts. Bradley and Roberts (2015) confirmed that firm characteristics such as greater size, more growth opportunities, and higher tangibility, reduce the probability of the presence of covenants in debt contracts, while factors such as higher leverage and volatility increase this likelihood. Reisel (2014) also confirmed the importance of characteristics like size, leverage, growth opportunities and tangibility on the structure of covenants: firms with higher leverage are more likely to have constraints on the payment of dividends and obtaining new financing, while larger firms, those with higher tangibility and market-to-book ratio are less subject to restrictions on investments, dividends and issuance of debt instruments.

With regard to the factors influencing the presence and breach of covenants involving Brazilian companies, we can mention the works of Konraht and Vicente (2019), Palhares et al. (2019), Konraht and Soares (2020), Oliveira and Monte-Mor (2020) and Duarte et al. (2020).

In line with the scope of this study, Konraht and Vicente (2019) found that the economic-financial and governance characteristics of their sample of firms (such as size, growth opportunities, and ownership concentration, among others) are important determinants both of the presence and number of covenants in the indentures of bonds issued via the B3 between 2010 and 2016. In turn, the characteristics of the debt (such as maturity and guarantees) only affected the presence of covenants in the indentures. Also analyzing a sample of bonds issued through the B3 in the 2011-2017 period, Palhares et al. (2019) observed that governance characteristics (such as ownership concentration and size of the board of directors) affected the number of covenants present in the respective indentures, as well as the probability of a more restrictive Net Debt/EBITDA covenant (below 3.5).

In turn, Konraht and Soares (2020) analyzed the relationship between use of covenants and the cost of debt obtained by issuing bonds, finding a positive relationship between the use of covenants binding only on the company and the spread. However, in the case of accounting covenants with joint and several obligations of the company and a guarantor, the relationship between the use of covenants and the spread was negative. The authors concluded that accounting

covenants have a dual role in obtaining debt financing in Brazil: in the case of the issuer, they function as a complementary mechanism to the risk premium, while, in the case of joint and several guarantors, they act as a substitute mechanism to reduce risk and the spread.

Oliveira and Monte-Mor (2020) analyzed the relationship between corporate governance and violation of covenants, finding that firms listed in the enhanced governance segments of the B3 were less likely to violate financial covenants. In turn, Duarte et al. (2020) examined whether firms that are close to breaching covenants have a greater level of earnings management. They confirmed that the firms in their sample that were near the threshold for violating covenants tended to manage earnings upward, confirming the expected relationship.

## 2.2. DEVELOPMENT OF THE RESEARCH HYPOTHESIS

Just like covenants, corporate governance mechanisms aim to align interests and reduce agency costs derived from the conflicts of interest between principal and agent, as described by Jensen and Meckling (1976). According to Shleifer and Vishny (1997), corporate governance is related to the way suppliers of capital assure a return on that investment by detecting whether the managers are investing in poor projects. In this sense, the authors stressed the role of legal protection of creditors and of ownership concentration as mechanisms able to assure a return on investments.

Shleifer and Vishny (1997) stated that, in many countries, legal protection of investors is weak, as a mechanism of governance, due to poor laws and/or difficulty of enforcement. In these countries, firms (including family firms) tend to maintain a high concentration of ownership for the purpose of assuring rights.

In this respect, Martins et al. (2020) pointed out that the efficiency of contracts depends both on internal governance aspects of the firm and the institutional arrangements that assure enforcement of the laws, affirming that the governance structures at the firm and country levels act together to minimize agency problems. They argued that, in countries with strong protection of the rights of minority shareholders and creditors, agency costs are lower, since creditors have more power to enforce contracts and the controlling shareholders have less room to act in discretionary form. This argumentation leads to the hypothesis that, in institutional settings with greater protection of minority shareholders and creditors, firms will choose debts with longer maturity, even in the presence of greater ownership concentration. On the contrary, in countries with weaker protection, the ownership structure will be negatively associated with debt maturity. The authors found evidence confirming this hypothesis, demonstrating that ownership concentration and debt maturity are alternative governance mechanisms.

As discussed by many researchers, such as Shleifer and Vishny (1997), Claessens and Fan (2002) and Silva et al. (2016), a high level of ownership concentration can generate different incentives and impacts, both positive and negative, on the generation of value by firms. These benefits derive from the incentive that controlling shareholders have in order to assure good performance of the firm, since through exercising their political rights (voting) to maximize their wealth, they winds up benefiting the other investors and agents involved. This is the alignment effect, described by Claessens and Fan (2002). At the same time, drawbacks exist, such as the possibility of a mismatch of interests between controlling and minority shareholders, whereby the former pursue personal interests, reducing the wealth of the latter. However, given the high ownership concentration found mainly in less developed markets, Shleifer and Vishny (1997) stated that the cost of low diversification does not appear to be greater than its benefits in many countries.

Thus, the institutional environment has a direct influence on the corporate governance arrangements. La Porta et al. (1999) found the existence of greater ownership concentration in weaker legal and institutional settings. Furthermore, according to Claessens and Fan (2002), the weak enforcement of property rights by the State is the most likely cause of high ownership concentration in Asia and other emerging markets, which in general have inefficient legal systems, poor application of laws, and high levels of corruption. Hence, in institutional settings with weak legal enforcement and low protection of the rights of shareholders and creditors, like Brazil, firms wind up exercising this role through internal governance systems, as also observed by Brandão and Crisóstomo (2015) and Palhares et al. (2019).

In this context, it is possible to expect that firms with greater ownership concentrations are perceived by creditors as having better management and presenting risk by creditors, considering the incentives controlling shareholders have to align interests and reach decisions that maximize the generation of value by the firm. According to Konraht and Vicente (2019), this behavior is able to reduce the risk of bankruptcy and can also be reflected in a reduced demand for covenants by creditors, leading to a negative relationship between ownership concentration and the presence of financial covenants. Therefore, we formulated the following hypothesis:

Hypothesis: A negative association exists between the level of ownership concentration and the intensity of covenants in debt contracts of companies listed on the B3.

In the next section, we present the models to test this hypothesis.

### 3. METHODOLOGY

#### 3.1. DATA AND SAMPLE

Our initial sample consisted of all Brazilian nonfinancial companies listed on the B3 (formally Brasil, Bolsa, Balcão) in the period from 2007 to 2018, for a total of 324 firms, excluding firms in the sectors of investment funds, finance, and insurance. This group was then filtered to detect firms with zero leverage and with fewer than two consecutive years of data for analysis. For years in which firms had leverage of zero or negative equity, the indicators were not calculated (missing values). After application of the filters and operationalization of all the variables, a total of 278 firms remained in the sample, with 2,844 observations (firm-years).

The accounting, financial, and market data were obtained from the Economatica database. These data were employed to calculate the explanatory variables representing the firms' characteristics. The data on covenants were gathered manually, directly from the notes to the financial statements of the firms at the B3 website. All told, we analyzed more than 4,000 explanatory notes referring to loans and financing in search of information on financial covenants.

In cases of the existence of more than one clause with the same index, we used the following criteria, in this order: 1) consider the clause attributed to the most representative debt (largest value); and 2) if it was not possible to identify the amount of the debt, consider the most restrictive clause, a criterion also used by Devos et al. (2017). The covenants referred to 17 different financial ratios, which were segregated in two groups: balance sheet covenants and income statement covenants, presented in Figure 1.



Covenants	
Group 1 - Balance Sheet Covenants	
Net Debt / EBITDA	Net Debt / EBITDA
Gross Debt / EBITDA	Gross Debt / EBITDA
Net Debt / Equity	Net Debt / Equity
Gross Debt / Equity	Gross Debt / Equity
Equity / Total Assets	Equity / Total Assets
CA / CL	Current Assets / Current Liabilities
LT Liability / Total Assets	Long-term Liability / Total Assets
Net Debt / (Net Debt + Equity)	Net Debt / (Net Debt + Equity)
Net ST Debt. / EBITDA	Net Short-term Debt / EBITDA
ST Debt / LT Debt	Short-term Debt / Long-term Debt
Group 2 - Performance Covenants	
EBITDA / Fin. Exp.	EBITDA / Financial Expense
EBITDA / Fin. Res.	EBITDA / Financial Result
DSCR	EBITDA / Debt Service (Principal + Interest)
EBIT / Fin. Exp.	EBIT / Financial Expense
EBIT / Fin. Res.	EBIT / Financial Result
EBITDA / Revenue	EBITDA / Revenue
Invest / EBITDA	Investment / EBITDA

**Figure 1.** Covenants disclosed in notes - firms listed on the B3

**Notes.** Net debt is equal to total gross debt minus cash and cash equivalents (cash and short-term financial investments); EBITDA is equal to earnings before interest, taxes, depreciation, and amortization; EBIT is equal to earnings before interest and taxes; DSCR denotes the debt service coverage ratio.

**Source:** Own elaboration.

### 3.2. VARIABLES AND MODELS

To investigate the relationship between ownership concentration and the use of covenants in the debt contracts of firms listed on the B3, we first carried out tests of the differences of means for the firms' characteristics, considering two subsamples of firms (with and without covenants), besides descriptive statistics.

Then we applied regression models (linear and nonlinear) in which the dependent variable was a dummy variable equal to 1 for firms reporting one or more covenants in a determined year, and 0 otherwise. To provide more robustness to the analysis, we estimated different models (compared in the next section), namely: linear probability models estimated by ordinary least squares (pooled and fixed affects) and binary response models estimated by maximum likelihood (pooled logit and probit). We also used logistic regression models with panel data estimated by fixed and random effects. Nevertheless, due to the possible inadequacy of the data to the inherent assumptions of these models (such as probable correlation between unobserved factors and the explanatory variables), their results are presented in the Appendix.

As explanatory variables, besides the proxy for ownership concentration, we considered control variables characteristic of the firms, traditionally used in studies of capital structure (Rajan & Zingales, 1995; Fama & French, 2002; Frank & Goyal, 2003; Myers, 2001; Baker & Wurgler, 2002), as well as in the literature on the structure of covenants (Demiroglu & James, 2010;



Reisel, 2014; Bradley & Roberts, 2015; Konraht & Vicente, 2019; Palhares et al., 2019; Oliveira & Monte-Mor, 2020). The expected relationship between these variables and the dependent variables are discussed in the next section. The general equation of the models was the following:

$$Y_{i,t} = \alpha_0 + \beta_1 \text{Own\_Conc}_{i,t} + \beta_2 \text{Lev}_{i,t} + \beta_3 \text{Size}_{i,t} + \beta_4 \text{Tang}_{i,t} + \beta_5 \text{Prof}_{i,t} + \beta_6 \text{Grow.opp}_{i,t} + \beta_7 \text{Liq}_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where:  $Y_{i,t}$  represents the presence of covenants. To test our hypothesis, we first used binary response models in which  $Y_{i,t}$  is a dummy variable that assumes value of 1 if firm  $i$  has at least one financial covenant in year  $t$ , and 0 otherwise. Subsequently we analyzed the intensity of the presence of covenants in models where the dependent variable  $Y_{i,t}$  is the natural logarithm of the number of covenants reported by firm  $i$  in year  $t$ , is equal to the level of ownership concentration, denotes leverage, represents the size of firm  $i$  in year  $t$ , denotes tangibility, stands for profitability, represents growth opportunities, and is equal to liquidity. The operationalization of the variables is described in Figure 2.

To analyze the determinants of the presence of covenants, we estimated both variations of a linear probability model (i.e., estimation by ordinary least squares) and logit and probit models. According to Angrist and Pischke (2008), the advantage of OLS estimation, even with a binary dependent variable, is that the model has less restrictive presuppositions about the distribution of errors, which in our case allowed the inclusion of firm fixed effects. On the other hand, logit and probit models guarantee that the estimated dependent variable must be within the 0 to 1 interval.

Dependent Variables	Abbreviation	Operationalization
Dummy for presence of covenants	<i>CovDummy</i>	Dummy equal to 1 for firms with a covenant in a determined year
Intensity of covenants	<i>CovInt</i>	Number of covenants of a determined firm in a determined year
Explanatory Variable		
Ownership Concentration	<i>Own_Conc</i>	% held by the 3 largest shareholders with voting rights
Control Variables		
Leverage	<i>Debt/Assets</i>	Gross Debt / Total Assets
Size	<i>Ln(Revenue)</i>	Ln(Revenue)
Tangibility	<i>PPE/Assets</i>	Property, Plant & Equipment / Assets
Profitability	<i>ROI</i>	Return on investment = net profit + financial expense net of income tax / (debt + equity)
Growth Opportunities	<i>Market-to-book</i>	Market value to book value of assets
Liquidity	<i>Liquidity</i>	Current Assets / Current Liabilities

**Figure 2.** Operationalization of the model's variables

**Notes.** *Ln* means the natural logarithm; *ROI* denotes return on investments, equal to the sum of net profit plus financial expenses net of income tax divided by the sum of gross debt and net equity at market value; marginal tax rate of 34%; *Gross Debt* is equal to the sum of loans and financing, bonds and short- and long-term financial leasing obligations; and *Market-to-book* is equal to the market value of equity over the book value or equity.

**Source:** Own elaboration.

To analyze the determinants of the intensity of the presence of covenants, besides the linear models (pooled and fixed-effect), we employed a nonlinear model for count data, since the dependent variable presented discrete and non-negative values (number of covenants disclosed by a determined firm). Through the test proposed by Cameron and Trivedi (1990), we found overdispersion of the data determining the dependent variable, making the estimation of a Poisson regression model less advisable, so, as recommended by Fávero and Belfiore (2017), we used a negative binomial regression model, estimated by maximum likelihood.

All the regressions were estimated with robust standard errors and clusterization by firm, to consider the possible existence of heteroscedasticity and serial correlation of the error terms, as well as the inclusion of dummies for time (year) in all the specifications to account for the temporal trend of greater presence (or disclosure) of covenants in more recent periods of the sampled interval, as shown in Figure 3 (further below). Besides these actions, all the independent variables were winsorized at the 2.5% and 97.5% percentiles to mitigate the effect of outliers.

Finally, a limitation of the empirical strategy used is that the firms with covenants in their debt contracts might be inherently different from firms without restrictive clauses with respect to unobserved characteristics, which can give rise to selection bias. For this reason, care must be taken in the economic interpretation of the regression coefficients. We prefer to treat the results presented below as associations rather than causal relations.

## 4. RESULTS

### 4.1. DESCRIPTIVE ANALYSIS: PANORAMA OF THE PRESENCE OF FINANCIAL COVENANTS OF FIRMS LISTED ON THE B3

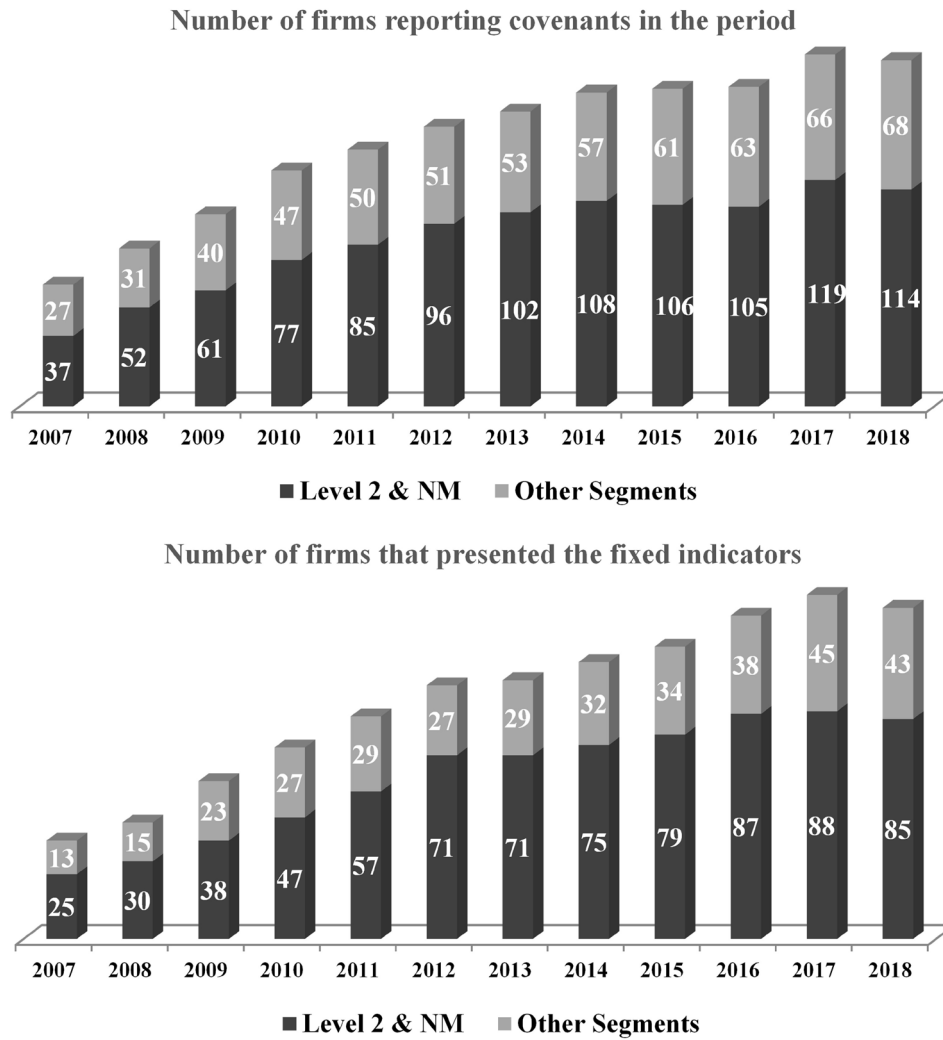
#### 4.1.1. *Level of disclosure and frequency of covenants in financial statement notes*

Figure 3 presents the number of firms that disclosed the presence of covenants in debt contracts in each year, along with the number of firms that also reported the ratio set by the creditors (limit if the covenant). The number of firms analyzed in all years was 278 (fixed panel in the period from 2007 to 2018).

Figure 3 indicates that the disclosure of this information increased with time. In all the years, the firms listed in the two highest enhanced governance segments of the B3 (New Market and Level 2, shown in dark gray) had rising disclosure of information with time. Furthermore, in all years, the number of firms listed in those two enhanced governance trading segments (dark gray) was larger than the number in the other segments (light gray). This pattern can indicate better disclosure by the firms in these two segments. However, it is also possible that the firms in these two segments had more restrictive clauses for being more leveraged in the period studied.

The second graph in Figure 3 shows the number of firms that, besides disclosing the presence of covenants, also described the indicator(s) contained in their debt contracts. Approximately one-third of the firms that reported having covenants did not disclose the types, hampering a deeper analysis of indicators other than Net Debt/EBITDA. Also in this respect, the firms in the New Market and Level 2 segments had a greater level of disclosure than the other firms.

Table 1 presents the types of covenants most often disclosed in notes related to loans and financing by the firms listed on the B3 during the sample period. There are a total of 2,493 disclosures of covenants, with the two main ones being Net Debt/EBITDA (38.1%) and EBITDA/Financial



**Figure 3.** Firms listed on the B3 that disclosed covenants

**Notes:** During the years, we analyzed a fixed panel of 278 firms listed on the B3.

**Source:** Research data.

Result (16.8%), thus together accounting for more than half of the covenants reported by the firms. All the other indicators had frequency less than 10%, as shown in Table 1.

Figure 4 shows the frequency of the long-term ratios. Note that the use of the Net Debt/EBITDA ratio grew faster than the others during the period studied.

To examine the intensity of covenants, Table 2 identifies the number of observations (firm years) with firms disclosing 1, 2, 3 or more than 3 covenants in a determined year. Nearly half of the observations presented 2 covenants in debt contracts

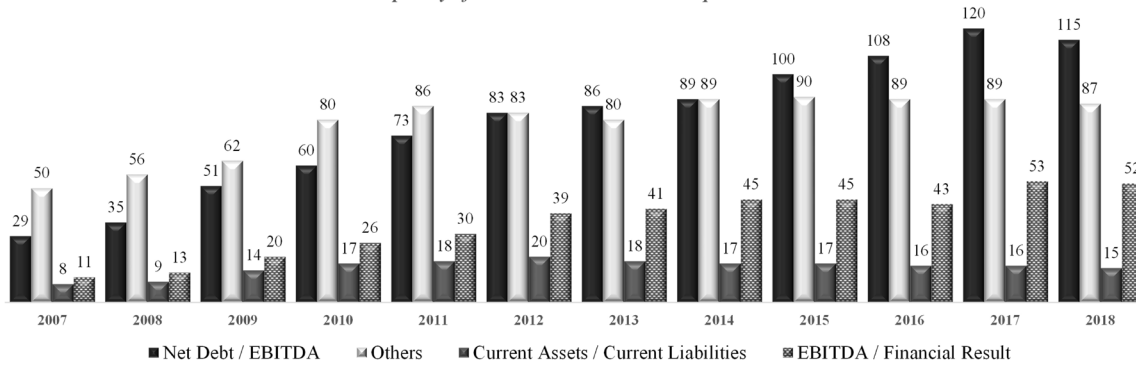
**Table 1***Frequency of covenants - firms listed on the B3*

Covenant	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Obs.	Freq. (%)
Net Debt / EBITDA	29	35	51	60	73	83	86	89	100	108	120	115	949	38,1%
EBITDA / Financial Result	11	13	20	26	30	39	41	45	45	43	53	52	418	16,8%
Current Assets / Current Liabilities	8	9	14	17	18	20	18	17	17	16	16	15	185	7,4%
EBITDA / Financial Expense	8	7	13	14	16	14	11	16	18	19	20	16	172	6,9%
Equity / Total Assets	4	6	7	10	11	10	13	11	14	13	15	18	132	5,3%
Net Debt. / Equity	8	9	9	13	9	12	11	15	12	12	9	10	129	5,2%
EBITDA / Debt Service	5	6	7	8	10	12	13	12	11	11	16	16	127	5,1%
EBITDA / Revenue	3	4	5	7	8	10	11	10	8	8	6	6	86	3,4%
Gross Debt / EBITDA	6	7	7	10	9	6	3	5	6	4	4	4	71	2,8%
Net Debt / (Net Debt + Equity)	5	4	5	6	8	5	3	4	5	6	4	4	59	2,4%
Long-Term Liability / Total Assets	1	1	2	3	4	7	7	6	6	7	6	6	56	2,2%
Gross Debt / Equity	5	6	2	3	3	2	4	5	4	4	4	3	45	1,8%
EBIT / Financial Expense	1	1	1	1	1	1	1	2	2	2	2	2	17	0,7%
Net Short-Term Debt / EBITDA	1	3	2	3	4	1	0	0	1	1	0	0	16	0,6%
Investment / EBITDA	2	2	2	2	2	2	1	0	0	0	1	0	14	0,6%
Short-term Debt / Long-term Debt	1	0	0	0	0	0	1	2	2	2	2	2	12	0,5%
EBIT / Financial Result	0	0	0	0	1	1	1	1	1	0	0	0	5	0,2%
<b>Total</b>													2493	100,0%

**Notes.** ST denotes short term; LT means long term; A single company can have more than one restrictive clause in a given year, so that the total number of indicators disclosed is greater than the number of firm-years (described in Figure 3).

**Source:** Research data.

Frequency of the main covenants in the period

**Figure 4.** Frequency by type of covenant during the years studied - firms listed on the B3**Source:** Research data.**Table 2***Intensity of covenants - firms listed on the B3*

Number of Covenants	Intensity of the Presence of Covenants		
	Firm-Years	Total	%
1	292	292	11,7%
2	511	1.022	41,0%
3	185	555	22,3%
4	85	340	13,6%
5	41	205	8,2%
6	12	72	2,9%
7	1	7	0,3%
<b>Total</b>	<b>1127</b>	<b>2493</b>	<b>100%</b>

**Source:** Research data.

#### 4.1.2. Analysis of the indicators disclosed versus characteristics of the firms

Here we analyze whether there were any differences between firms that disclosed covenants and those that did not. Table 3 presents the average of the indicators, segregated between companies that reported financial covenants (dummy for covenants = 1) and those that did not have or did not disclose covenants (dummy for covenants = 0). We used the t-test to analyze the differences of means.

The results in Table 3 show that the groups had significant differences, mainly considering the levels of ownership concentration and metrics for leverage (debts/assets), size (natural logarithm of revenue) and liquidity. As expected, the indicator of ownership concentration is lower for the firms with covenants, indicating a possible negative relationship between the variables, which will be evaluated further in the analysis of the models. The liquidity indicator (current assets/current liabilities) is also lower for the group of firms with covenants, possibly due to their greater financial sophistication in managing their liquidity, which also might have influenced the result.

On the other hand, the firms that reported covenants also are those with the highest leverage (33.9% versus 22.6%), given the presence of restrictive clauses on higher debt levels. The companies are also larger than those without covenants, measured by the natural logarithm

**Table 3**  
*Financial characteristics of the firms with and without the presence of covenants*

Variables	Total Sample			Without Covenants			With Covenants			Differences	
	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.	(t-value)	(z-value)
Own_Conc	69,139	70,696	2.755	72,061	75,323	1.193	67,216	68,830	1.562	5,481***	126,010***
Debt/Assets	0,293	0,295	2.689	0,226	0,207	1.092	0,339	0,337	1.597	-18,949***	-2,890***
Ln(revenue)	7,027	7,075	2.771	6,151	6,055	1.169	7,666	7,719	1.602	-23,383***	-39,378***
PPE	0,262	0,215	2.844	0,255	0,195	1.234	0,267	0,230	1.610	-1,327	-0,315
ROI	0,101	0,096	2.796	0,103	0,097	1.215	0,099	0,096	1.581	0,937	0,109
M/B	1,357	1,138	2.529	1,361	1,115	1.072	1,353	1,148	1.457	0,266	0,180
Liquidity	1,985	1,573	2.840	2,356	1,712	1.230	1,702	1,518	1.610	11,636***	17,276***

**Notes.** The complete description of the variables and their form of operationalization was presented in Figure 2.

**Source:** Research data.

of total revenue, probably by the fact that larger firms tend to have more detailed accounting disclosure and a larger volume of debt. These results were also obtained by Devos et al. (2017) in analyzing American firms. The other indicators were similar between the groups, without significant differences in terms of means or medians.

#### *4.1.3. Analysis of the frequency of breaching the Net Debt/EBITDA covenant and position of the firms listed on the B3*

As mentioned, about one-third of the companies in the sample did not identify the limits of the covenants established in their debt contracts, and, among the firms that did identify these indicators (limits set by creditors), most did not present the value of the ratio (observed) in the year, preventing knowledge of the distance to violating the covenants in question.

To deepen the analysis regarding the position of the firms in relation to the threshold for breaching the main covenant (Net Debt/EBITDA), we estimated the values of this indicator for the firms that disclosed the clause established in the debt contract (limit of the covenant) but did not disclose the real indicator in the year under analysis (observed indicator). For the firms that reported both the existence of the clause and the limit established, we considered that limit, since it was the most accurate value, by already incorporating the adjustments agreed with creditors.

The other indicators had a very small number of observations, preventing more detailed analyses. The EBITDA/Financial Result ratio was the second most mentioned in the financial statement notes (16.8% of the total). Nevertheless, the wide range of formulas to calculate this indicator (mainly considering the denominator) made its estimation doubtful regarding its representativeness. Thus, we chose only to estimate the indicator Net Debt/EBITDA for the firms that did not report the observed value.

Table 4 reports the descriptive statistics. The average of the Net Debt/EBITDA indicator was 3.38 for the total sample, with the firms generally being far from violating this covenant, since its average limit was 2.75 (the lower the better). Most of the firms satisfied this covenant. In contrast, the average value of this indicator among the firms that violated the covenant was 5.22 versus the average threshold of 3.43.

**Table 4**  
*Analysis of the Net Debt/EBITDA covenant*

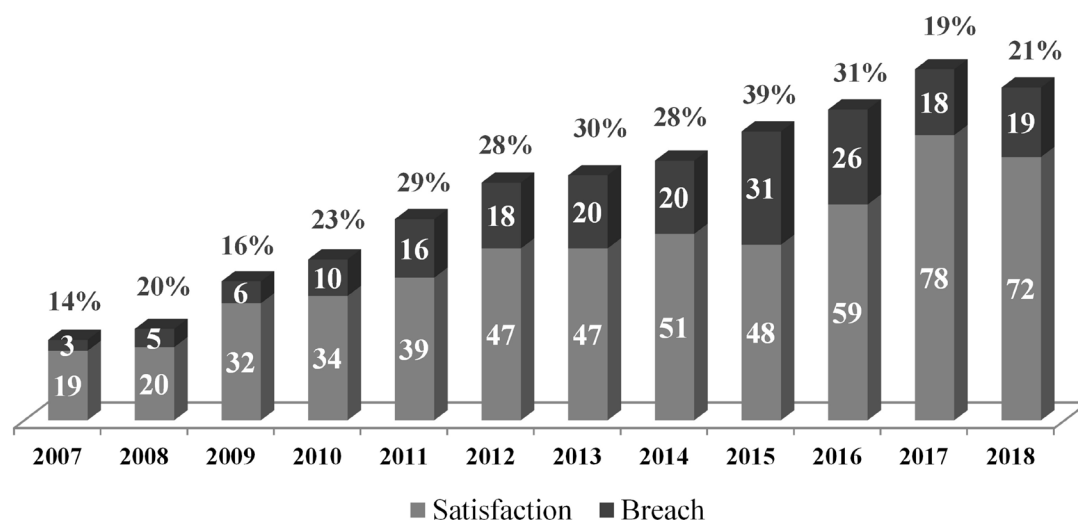
	Analysis of Net Debt / EBITDA Covenant								
	Full Sample			Firms with no Breach of Covenants			Firms that Breached a Covenant		
	Mean	Median	Obs.	Mean	Median	Obs.	Mean	Median	Obs.
Covenant Limit	3,38	3,50	738	3,36	3,50	546	3,43	3,50	192
Observed Covenant	2,75	2,32	738	1,88	1,83	546	5,22	4,57	192
Debt/Assets	0,37	0,36	727	0,34	0,33	536	0,45	0,47	191

**Notes.** Covenant Limit refers to the limit established in the contract and disclosed by the company in notes; Observed Covenant refers to the real indicator presented by the company in a determined year; the number of observations with covenant limit disclosed is substantially smaller than the number of firms that disclosed the existence of covenants.

**Source:** Research data.



Figure 5 shows the frequencies of satisfying and breaching the Net Debt/EBITDA covenant during the years studied. All told, 192 of the 738 observations presented breach (26% of the sample), and the greatest frequencies of default occurred in 2015 and 2016. This result is possibly a reflection of the recession in those years, which diminished the cash flow generated by companies and caused them to resort to higher leverage.



**Figure 5.** Breach of the Net Debt/EBITDA covenant during the years - firms listed on the B3 that disclosed the established covenant limits

**Notes.** The figure shows the number of observations of satisfied covenants (in light gray) and breached covenants (in dark gray) for each year. The number of observations with covenant limits disclosed is substantially lower than the number of firms that reported being subject to covenants.

**Source:** Research data.

Table 5 reports the frequency of breaching the Net Debt/EBITDA covenant by economic sector. The greatest default rate occurred in the electric power sector (20% of the sample), a reflection of the higher level of indebtedness of companies in the sector, especially in the two recession years.

Table 6 presents the frequency distribution of the firms that violated the Net Debt/EBITDA covenant in intervals of 20%. It also contains the covenant slack for the firms that did not breach any covenants, i.e., the distance from the threshold for covenant default, also in intervals of 20%. A total of 39% of the observations exceeded the covenant by up to 20%. In the case of firms that did not breach the referred covenant, while the greatest portion (46% of the total) presented slack of up to 40%.

Regarding the results obtained, we stress the importance of a deeper analysis of the explanatory notes published by these firms, to search for information about renegotiation of the restrictive debt clauses, leading to waivers.

The international literature contains evidence of frequent renegotiation of contracts. Denis and Wang (2014) found that, even in the absence of default, firms and their creditors often renegotiate clauses. According to the authors, this generally results in relaxation of the restrictions, resulting in large changes in the limits. Evidence in this sense was also reported by Roberts (2015), who observed that a typical debt agreement is renegotiated five times during its existence, every nine months, with the contractual characteristics (such as pricing, maturity, amount and covenants) changing substantially with each renegotiation.

**Table 5***Frequency of breach of the Net Debt/EBITDA covenant by sector*

Sector	Covenant: Net Debt/EBITDA			
	Satisfaction Obs.	Breach Obs.	Total Obs.	Freq. of Breach (%)
Agriculture and fishing	7	0	7	0%
Food and beverages	22	9	31	5%
Retailing	54	22	76	11%
Construction	1	2	3	1%
Electrical/electronics	1	0	1	0%
Electricity	116	38	154	20%
Non-metallic minerals	5	2	7	1%
Mining	7	5	12	3%
Others	176	55	231	29%
Pulp and paper	9	10	19	5%
Oil and gas	24	1	25	1%
Chemicals	7	0	7	0%
Steel and metallurgy	13	10	23	5%
Software and data processing	10	0	10	0%
Transport services	70	25	95	13%
Textiles	19	10	29	5%
Vehicles and parts	5	3	8	2%
<b>Total</b>	<b>546</b>	<b>192</b>	<b>738</b>	<b>100%</b>

*Note.* Sector classification according to Economatica.*Source:* Research data.**Table 6***Analysis of the magnitude of the breach of covenants and covenant slack*

Cov. Breach	Covenant Breach: Net Debt/EBITDA					Total
	up to 20%	20% to 40%	40% to 60%	60% to 80%	above 80%	
Obs.	74	33	23	12	50	192
Freq. (%)	39%	17%	12%	6%	26%	100%
Cov. Slack	Covenant Slack: Net Debt/EBITDA					Total
	up to 20%	20% to 40%	40% to 60%	60% to 80%	above 80%	
Obs.	125	126	132	76	87	546
Freq. (%)	23%	23%	24%	14%	16%	100%

*Notes.* Covenant slack refers to the percentage distance or slack to breaching the covenant, consisting of the difference between the value calculated (or observed) and the limit of the established covenant divided by the covenant limit.*Source:* Research data.

It remains to be known if Brazilian firms frequently renegotiate their debt contracts or manage their capital structure before approaching the limits established in covenants, thus avoiding the penalties set for default (i.e. accelerated maturity). This is a theme for future research.

#### 4.2. DETERMINANTS OF THE PRESENCE OF COVENANTS OF FIRMS LISTED ON THE B3

Table 7 presents the results of the regression models estimated to analyze the determinants of the presence of covenants. Columns (1) and (2) contain the results of the pooled logit and probit estimation by maximum likelihood. In turn, column (3) presents the odds ratio, to analyze the economic impact of the coefficients of the model in column (1), which indicates how many times the chance of occurrence of the event increases or decreases in function of alteration of one unit of a determined variable, keeping the others constant. Columns (4) and (5) contain the results of the linear models estimated by ordinary least squares (pooled and fixed-effect), all with robust standard errors clustered by firm and time dummies (year).

In Table A.1 (Appendix) we also present the results of the logistic regression models with panel data with estimation by fixed and random effects, even though the assumptions for these estimations are not very realistic: the logit model with fixed effects assumes the absence of serial correlation of the dependent variables after conditioning by the independent variables; and the logit model with random effects assumes no correlation between the unobserved heterogeneity (i.e., the random effect by firm) and the other independent variables.

In the estimations in columns (1) and (2), both coefficients are negative and statistically significant at the 10% level. The odds ratio, reported in column (3), indicates that an increase of one unit in a firm's ownership concentration would reduce by less than one unit the chance of inclusion of debt covenants. The coefficient reported in column (4) of Table 7 indicates that an increase of 1 percentage point in the ownership concentration is associated with a reduction of 0.15% in the probability of the existence of covenants, again statistically significant at 10%. In the estimation reported in column (5), which adds the firm fixed effects, the coefficient remains negative but loses statistical significance, which was expected given that both the presence of covenants and ownership concentration are highly stable variables in time for the same firm. Therefore, the magnitude of the coefficient is not very different from that observed in the estimation (4).

These results provide support for the hypothesis that firms with higher ownership concentration have a lower probability of having financial covenants in debt contracts, as already suggested by the descriptive analysis. In the estimations reported in Appendix A, which reports the coefficients of logistic models with fixed and random effects, the inferences do not change (and the coefficients are significant at the 1% level).

Konraht and Vicente (2019) also found a negative relation in one of the models tested, when examining the use of covenants in bond issues on the B3 in the period from 2010 to 2016, leading to the inference that a highly concentrated ownership structure (only a few shareholders) can signal a more creditworthy firm to lenders, reflected in lower risk of bankruptcy and a lesser need to impose contractual covenants. Our results corroborate the idea that ownership concentration can act as a substitute mechanism for governance, as observed by Martins et al. (2020), reducing the agency costs of debt, represented here by the imposition of covenants, which wind up reducing the financial flexibility of firms, and potentially hindering their value generation. Hence, as discussed by Shleifer and Vishny (1997), in settings with weak protection of creditors' rights, firms wind up adopting internal mechanisms to mitigate conflicts of interest and potential agency problems.

**Table 7**  
*Determinants of the presence of covenants*

	Dependent Variable (Y) = CovDummy				
	(1)	(2)	(3)	(4)	(5)
	Logit	Probit	Odds Ratio	Pooled OLS	Fixed-effect OLS
Explanatory variables	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Own_Conc	-0,819 *	-0,498 *	0,441	-0,147 *	-0,102
	(0.451)	(0.272)		(0.081)	(0.120)
Debt/Assets	3,521 ***	2,084 ***	33,804	0,651 ***	0,424***
	(0.761)	(0.445)		(0.129)	(0.138)
Ln(Revenue)	0,455 ***	0,255 ***	1,575	0,083 ***	0,050 **
	(0.086)	(0.047)		(0.013)	(0.024)
PPE/Assets	0,260	0,123	1,297	0,016	0,100
	(0.434)	(0.261)		(0.079)	(0.100)
ROI	-1,098	-0,564	0,334	-0,201	0,066
	(0.829)	(0.480)		(0.151)	(0.109)
Market-to-book	0,027	0,021	1,027	0,007	-0,033
	(0.146)	(0.087)		(0.026)	(0.027)
Liquidity	-0,086	-0,057	0,918	-0,018	-0,014
	(0.088)	(0.052)		(0.014)	(0.013)
Constant	-4,095 ***	-2,321 ***	0,017	-0,244 *	0,016
	(0.810)	(0.459)		(0.128)	(0.208)
Year dummies	Yes	Yes		Yes	Yes
Obs.	2.317	2.317		2.317	2.317
F				19,65 ***	8,15 ***
R2				0,252	0,169
Wald chi2	136,27 ***	154,20 ***			
Pseudo R2	0,211	0,208			
Area under ROC curve	0,796	0,795			
% correct classifications	74,88%				

**Notes.** Variables operationalized as reported in Chart 2; all the models were estimated with robust standard errors clustered by firm and dummies for time (year); Coeff.: estimated coefficients; standard error between parentheses below each coefficient; significance levels of 10%, 5% and 1% are denoted by \*, \*\* and \*\*\*, respectively.

**Source:** Research data.

With respect to the control variables, we stress the persistence of signs and significance of the variables size and leverage in all the models, indicating a positive relation between the metrics leverage and size and the likelihood of covenants. The positive relationship with leverage was expected, given the common use of covenants in debt contracts aiming to protect creditors' rights. Reisel (2014) and Bradley and Roberts (2015) also found a positive relationship between these variables for American companies.

In relation to the size variable, logic would indicate a negative relationship, since larger firms typically have better credit reputation and lower information asymmetry, so they pose a smaller credit risk (Rajan & Zingales, 1995), thus reducing the need for covenants. At the same time, the positive relationship found is explained by the fact that larger firms generally access more sources of financing (they are less financially constrained), and are hence more leveraged than other firms, all else equal, leading to a positive relationship with covenants. Palhares et al. (2019) also found a positive relationship between size and the number of covenants in the indentures of bonds issued via the B3.

Finally, we did not find a significant relationship between the presence of covenants and profitability, ratio of property, plant, and equipment over total assets, growth opportunities or liquidity in the models reported in Table 7.

Table 8 presents the results of the model involving the determinants of the intensity of covenants. Column (1) contains the results of estimating a negative binomial model and column (2) contains the IRR statistic, which allows analyzing the economic significance of the coefficients (marginal effect of the variables) of the model presented in column (1). Columns (3) and (4) contain the results of the linear models estimated by ordinary least squares (pooled and fixed effects). Likewise, all the models were estimated with robust standard errors clustered by firm and time dummies (year).

In regard to the expected relationship between ownership concentration and the intensity of covenants present in the debt contracts of firms listed on the B3, the negative sign of the coefficients of the variable *Own\_Conc* corroborates our hypothesis, but none of these coefficients are statistically significant at the usual levels. On the matter of the relationship between ownership concentration and the amplitude of covenants in bonds issued via the B3, Palhares et al. (2019) also found a negative relationship, but significant at 10% in only one of the models. Konraht and Vicente (2019) also verified a significant negative relationship between these variables based on a sample of bond issues via the B3. However, the authors used a Poisson regression model, unlike the models tested by us.

As for the the control variables, the results are coherent with those presented in Table 7. Once again, the metrics for leverage and size remain significant with a positive sign, indicating that larger and more leveraged firms in our sample had a greater number of covenants in debt contracts, a result also obtained by Palhares et al. (2019) for the size variable. We found the liquidity variable to be significant with a negative sign in one of the models, indicating that firms with higher liquidity presented a greater number of covenants. The other variables were not significant.

According to the results reported in Tables 7 and 8, the level of ownership concentration in our sample was negatively associated with the probability of the presence of covenants in debt contracts during the years studied, such that the higher the ownership concentration, the lower the likelihood of covenants was. However, the ownership structure defined by the firms did not affect the quantity (or intensity) of covenants, which rejects our hypothesis. Taken together, our results suggest the adoption of internal governance mechanisms by the firms, aiming to send positive signals to the market, align interests, and reduce potential agency costs of debt.

**Table 8**  
*Determinants of the intensity of covenants*

	Dependent Variable (Y) = CovInt			
	(1)	(2)	(3)	(4)
	Negative Binomial	IRR	Pooled OLS	Fixed-effect OLS
Explanatory variables	Coeff.	Coeff.	Coeff.	Coeff.
Own_Conc	-0,169 (0.322)	0,845	-0,073 (0.257)	-0,116 (0.281)
Debt/Assets	1,406*** (0.442)	4,079	1,170*** (0.360)	1,177*** (0.362)
Ln(Revenue)	0,256*** (0.046)	1,292	0,185*** (0.038)	0,050 (0.044)
PPE/Assets	0,230 (0.263)	1,259	0,173 (0.242)	-0,315 (0.254)
ROI	-0,588 (0.531)	0,556	-0,403 (0.355)	-0,121 (0.259)
Market-to-book	0,044 (0.114)	1,045	0,033 (0.088)	-0,062 (0.070)
Liquidity	-0,107 (0.071)	0,899	-0,040 (0.033)	-0,049** (0.024)
Constant	-2,660*** (0.519)	0,070	-0,934** (0.366)	0,369 (0.382)
Year dummies	Yes		Yes	Yes
Obs.	2.314		2.314	2.314
F			6,85 ***	4,87***
R2			0,130	0,077
Wald chi2	105,71***			
Pseudo R2	0,05			

**Notes.** Variables are operationalized as reported in Chart 2; all the models were estimated with robust standard errors, clustered by firm and time dummies (year); Coeff.: coefficients estimated; standard error between parentheses below each coefficient; significance levels of 10%, 5% and 1% are denoted by \*, \*\* and \*\*\*, respectively.

**Source:** Research data.

## 5. FINAL CONSIDERATIONS

The goal of this study was to investigate whether a greater level of ownership concentration would reduce the probability of the presence of covenants in the debt contracts of firms listed on the B3 in the 2007-2018 period. We also sought to present a panorama of the covenants of these firms in the period analyzed, and present evidence of the positions of these firms regarding default of the main indicator used in the covenants, Net Debt/EBITDA.

In general, we identified 17 types of covenants by means of mapping, with two being most common: Net Debt/EBITDA and EBITDA/Financial Result, which together represented more than half of the observations of covenants. With regard to the disclosure of this information, we found that firms listed in the New Market and Level 2 enhanced governance segments of the B3 disclosed a greater number than the other firms, indicating higher disclosure quality.

In relation to the models, the results demonstrated that higher levels of ownership concentration were associated with lower probability of the presence of covenants in debt contracts, corroborating the role of the ownership structure as a substitute mechanism to governance able to align interests and reduce the risk perceived by creditors, leading to a lesser need to impose covenants in contracts.

This relationship is expected in settings with weak legal enforcement and protection of creditors' rights, such as Brazil, prompting firms to adopt internal governance mechanisms to guarantee alignment of interests and reduce agency problems. In this sense, by reducing the imposition of covenants, high ownership concentration winds up reducing the cost of debt as a funding source, allowing firms to be more flexible in the process of making financial decisions, crucial to achieve their objective of generating value. Nevertheless, the results rejected our hypothesis of a negative association of ownership concentration with the number of covenants. This result might have been generated by the fact that a large portion of the firms had on average 2 or 3 financial covenants, causing low variation of this indicator in the models.

We also found that, on average, the firms were far from exceeding the limits established for breach of the Net Debt/EBITDA covenant, with 2015 and 2016 (recession years) presenting the greatest default, with the greatest frequency in the electric power sector. On the other hand, it is common for firms to renegotiate debt agreements before the covenants are violated. Therefore, examining the role of these waivers can also make relevant contributions to the analysis of the impact of the presence of covenants on the financing and investment policies of Brazilian firms.

An important limitation of this study is that when there was no information related to covenants, we could not distinguish whether the firm did not have any or chose not to disclose their existence in the financial statement notes. Hence, the models presented may not have fully captured the effect of the explanatory variables on the determination of covenants. Besides this, the heterogeneity of the level of disclosure about covenants by the Brazilian firms did not permit broader analyses of the indicators. Finally, factors other than those considered in the models might have impacted the use of covenants.

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#### AUTHORS' CONTRIBUTIONS

TA – Definition of the research problem, description of the theoretical framework, design of the methodology, collection of data, estimation of the econometric models, analysis of the data and results and writing the text.

RFS – Definition of the research problem, design of the methodology, structuring of the econometric models, analysis of the data and results, and revision of the text.

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#### CONFLICTS OF INTEREST

There are no conflicts of interest to declare.

## ADDITIONAL MODELS

**Table A.1***Determinants of the presence of covenants*

Explanatory variables	Dependent Variable (Y) = CovDummy	
	(1)	(2)
	Fixed-effect Logit	Random-effect Logit
	Coeff.	Coeff.
Own_Conc	-3,7713 *** (1.015)	-3,0609 *** (0.772)
Debt/Assets	4,1822 *** (1.060)	5,6602 *** (0.936)
Ln(Revenue)	0,5714 *** (0.195)	0,8892 *** (0.124)
PPE/Assets	1,1899 (0.769)	1,2329* (0.654)
ROI	0,5884 (1.073)	0,0857 (0.999)
Market-to-book	-0,4840 ** (0.229)	-0,3517 * (0.205)
Liquidity	-0,0328 (0.109)	-0,0950 (0.102)
Constant		-6,6001 *** (1,175)
Year dummies	Sim	Sim
Obs.	1.245	2.317
LR chi2	357,16 ***	
Wald chi2		265,59 ***

**Notes.** The variables were operationalized as reported in Figure 2; Coeff.: coefficients of the logistic regression models with panel data estimated by fixed effects (1) and random effects (2); standard error in parentheses, below each coefficient; significance levels of 10%, 5% and 1% are denoted by \*, \*\* and \*\*\*, respectively.

**Source:** Research data.